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**Proposed Standards and Guidelines  
for Mobile Survey Instrument Design**

Lin Wang  
Christopher Antoun  
Brian Falcone  
Shelley Feuer  
Ivonne Figueroa  
Elizabeth Nichols  
Erica Olmsted-Hawala  
Alda Rivas

Center for Behavioral Science Methods  
Research and Methodology Directorate  
U.S. Census Bureau  
Washington, D.C. 20233

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## Abstract

Survey instruments are commonly used to obtain self-reported data from persons responding to survey questions. With the growing use of mobile devices, many surveys are now administered through survey instruments running on smartphones (mobile survey instruments). A key concern over mobile survey instruments is the design of the smartphone screen (user interface) because it can have a significant impact on response quality. The user interface of a mobile survey instrument is where survey responses are made. An inappropriately designed user interface can introduce measurement errors by influencing respondents' perception (acquiring information of survey questions) and action (entering responses). Optimizing the mobile survey instrument's user interface is thus crucial for reducing measurement errors. In an attempt to reduce measurement errors and to improve respondents' experience, four standards and 30 guidelines for mobile survey design are proposed in this document. All the standards and guidelines are based on empirical evidences. The target readers of this document are survey researchers and practitioners.

**Keywords:** Mobile survey, Survey design, Survey instrument, Standard, Guideline

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# PROPOSED STANDARDS AND GUIDELINES FOR MOBILE SURVEY INSTRUMENT DESIGN

IOE 2015 BCase 01 Project Team

First Edition

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*Technical Lead and Editor:*  
Lin Wang

*Contributing Authors (in alphabetical order):*  
Christopher Antoun, Brian Falcone, Shelley Feuer, Ivonne Figueroa,  
Elizabeth Nichols, Erica Olmsted-Hawala, Alda Rivas, Lin Wang

*Project Manager:*  
Russell Sanders

*Champions:*  
Harry Lee, John Abowd



## **Disclaimer**

This document is released to inform interested parties of research and to encourage discussion. The views expressed are those of the authors and not those of the U.S. Census Bureau.

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# 1 Introduction

Survey instruments are commonly used to obtain self-reported data from persons responding to survey questions. With the growing use of mobile devices (Smith 2015), many surveys are now administered through survey instruments running on smartphones (mobile survey instruments). A key concern over mobile survey instruments is the design of the smartphone screen (user interface) because it can have a significant impact on response quality. The user interface of a mobile survey instrument is where survey responses are made. In terms of the Total Survey Error Framework (Groves et al 2004), an inappropriately designed user interface can introduce measurement errors by influencing respondents' perception (acquiring information of survey questions) and action (entering responses), as schematically illustrated in Figure 1. Optimizing the mobile survey instrument's user interface is thus crucial for reducing measurement errors.

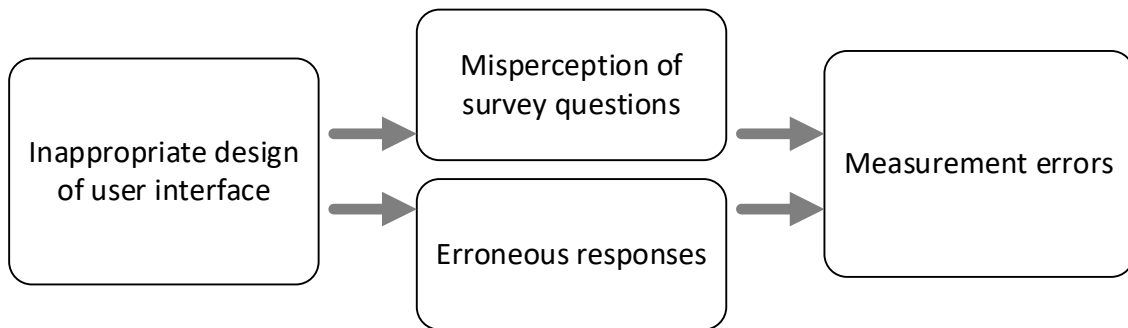


Figure 1. A schematic illustration of the relationship between inappropriate design of mobile survey user interface and measurement errors, mediated by misperception of survey questions and erroneous responses.

Smartphones' small screen size and touch interface creates usability challenges affecting the effectiveness, efficiency, and satisfaction of respondents' interaction with the survey instrument. Inadequate interface design could result in erroneous responses, prolonged time in completing a survey, and breakoffs (the respondent quits the survey before it is completed). In addition, it could be costly to re-design and re-build a user interface. To address these important issues, we initiated this project of developing evidence-based proposed standards and guidelines for mobile survey instrument design through a systematic and multidisciplinary approach.

Completing a survey on a smartphone consists of a series of human-machine interactions: the respondent and the instrument comprise a closed-loop human-machine system with multiple exchanges of information between the two components. We started the process of developing the proposed standards and guidelines by constructing an Information Processing Model for Mobile Survey Operation (MoSO), as shown in Figure 2. Figure 2 illustrates the information flow from perceiving survey questions displayed on a

smartphone screen to the human brain and to a fingertip that enters survey responses. In MoSO, three critical factors have direct implications for the quality of survey data collection: respondent's vision, fingertip size and mobility, and cognitive capacity.

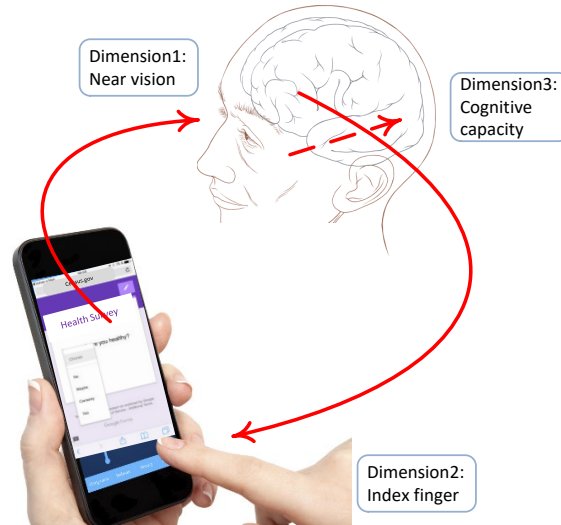


Figure 2. A graphical illustration of Information Processing Model of Mobile Survey Operation (MoSO).

Table 1. Mobile Survey Respondent Model (MSR)

Dimension I: Near vision (for reading)	Habitual visual acuity: around 20/20
	Normal contrast sensitivity
	Color blindness
Dimension II: Index finger	Operating fingertip breadth: 13 mm
	Operating finger mobility: stiff but able to operate a smartphone
Dimension III: Cognitive ability	Mentally alert
	Language: fluent in English
	Education: 8th grade or equivalent

Based on MoSO, we constructed a Mobile Survey Respondent Model (MSR), as outlined in Table 1. MSR prescribes the minimum mental and physical capacity upon which the proposed mobile survey standards and guidelines are to be built. Anyone who has the same physical and mental capabilities as the MSR or better should be able to successfully complete a mobile survey that is designed in compliance with the proposed standards and guidelines listed in this document. The MSR has three dimensions: vision, operating fingertip (the tip of the finger that is being used to touch a smartphone screen) and finger mobility (or stiffness), and cognitive capacity. The MSR represents a respondent who has habitual near vision (the vision one normally possesses in daily living, with or without eye



classes) around 20/20, normal contrast sensitivity (the visual ability to detect subtle differences in shading and patterns), and color blindness; whose operating fingertip has the breadth of 13 mm, and whose fingers are stiff but able to operate a smartphone; who is mentally alert, has 8-year school-education or equivalent, and is fluent in English.

This document includes two types of mobile survey design guidance: proposed standards and guidelines. *Standards* concern the basic operations across different elements of survey responses. For example, a response button in a choose-one response option design and a “Next” button in a screen navigation design are two different action icons. However, tapping a button is a common operation across all buttons, and consequently, the size of a button is a feature that affects the outcome of button tapping. A standard on minimum button size is thus warranted. Standards should be considered as rules by which all design parts must comply. *Guidelines* concern specific survey response operations, such as date entry. Guidelines can be deemed as “best practices” that are recommended but not mandatory.

The proposed standards and guidelines were developed through a systematic approach, including three steps: formulating topics, gathering evidence, and establishing standards/guidelines based on evidence. First, we conducted brainstorming sessions to come up with topics for standards and guidelines. Second, for each topic, a literature review was conducted to search for evidence. If sufficient evidence was found in literature, the evidence would be used to establish a standard or guideline. Otherwise, a behavioral experiment would be conducted to generate evidence. We adopted a hierarchy of evidence strength (Glover et al 2006) with expert opinions being weakest and systematic reviews being strongest. For the present study, the criterion for minimum evidence in literature was defined as at least two critically appraised individual studies (which is in the middle of the evidence hierarchy) being found in support of a standard or guideline. Existing guidelines or standards published by professional authorities were considered at the strength level of systematic review. Behavioral experiments were generally designed to address a comparative effectiveness question, e.g., *Do participants complete a survey/task designed with Method A more effectively, more efficiently, and/or with better satisfaction than Method B?*

Participants’ performance in a behavioral experiment was assessed in terms of effectiveness, efficiency, and satisfaction with performing a task (e.g., completing a survey). Effectiveness refers to accuracy and completeness with which participants perform the task (e.g., no errors made in survey responses); efficiency refers to resources used in relation to the results achieved (e.g., taking 5 min to complete a survey); and satisfaction refers to the extent to which the participants’ physical, cognitive, and emotional responses that result from task performance (ISO 2018). Among these three aspects, effectiveness is most important, efficiency second, and satisfaction third. An erroneous survey response is useless regardless efficiency and satisfaction. An inefficient survey response is not desirable but may still be useful. A dissatisfied respondent can still efficiently provide accurate responses. We thus devised a 3-step protocol for assessing experimental outcomes: Step 1 - if one method is more effective than others, the more effective method is selected. If all methods are equally effective, then go to Step 2 - if one method is more efficient than others, the more efficient method is selected. If all methods are equally

effective and efficient, then go to Step 3 - if participants are more satisfied with one method than others, the more satisfied method is selected. Otherwise, all methods are selected. We are cognizant that some evidence for individual standards/guidelines appears modest. That being said, the cumulative effect of adopting such small recommendations could produce an experience that is significantly better on the whole.

The present edition includes four proposed standards covering three categories of basic elements: (1) touch target size, (2) text display, and (3) luminance and color; and 30 guidelines covering four types of components in a mobile survey display: (1) question instructions, (2) question stem, (3) response options, and (4) supporting features (e.g., navigation, help links). Evidence for two standards and five guidelines were collected solely through literature review, evidence for two standards and 16 guidelines were collected solely through experiments, and the rest through a combination of literature review and behavioral experiments. Among the 30 guidelines, 26 guidelines were developed for self-administered survey designs, while four guidelines were developed for interviewer-administered survey designs. Most standards and guidelines are applicable to an indoor data collection setting, while one guideline is specifically developed for an outdoor data collection setting.

We hope that readers find this document informative and useful.

## 2 Proposed Standards

Standards concern the basic operations across different elements of survey responses and should be considered as basic rules by which all design parts must comply. In the present edition, the proposed standards cover three categories of basic elements: (1) touch target size, (2) text display, and (3) luminance and color. The table below provides a quick guide to each standard.

Category	Relevant Proposed Standards
Touch target size	Standard 1
Text display	Standard 2
Luminance and color	Standard 3, 4

## 1. Size of Touch Button: at least 6 mm of square side or circle diameter

**Supporting Evidence:** Two studies were conducted to compare usability among square/circular touch button (target) designs: square side or circle diameter ranging from 2 mm to 11 mm. The findings show that target-touch success increases with target size, and starting around 6 mm of square side or circle diameter, target-touch success rate exceeds 80%. (Wang 2022: Exp 1 report, Wang 2022: Exp 2 report).

### Exhibit

The following wireframe depicts a design of 6-mm radio buttons as response option icons

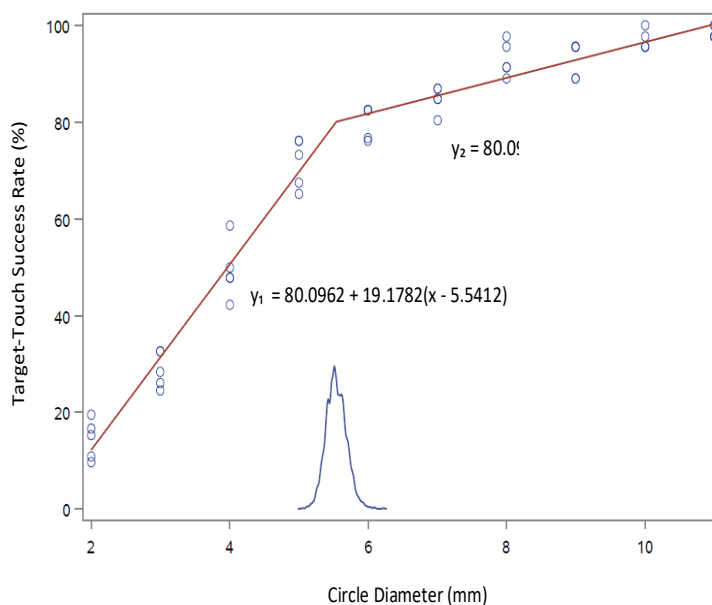
We depend too much on science and not enough on faith.

- ☐ 1 = strongly disagree
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 = strongly agree

Previous

Next

The graph below shows the success rate of touching a circular target as a function of target diameter: success rate rapidly increases to above 80% when target size increases from 2 mm to 6 mm, then the curve is bent. Similar behaviors were observed for a



## 2. Font Size for Text Display: at least 2-mm x-height

**Supporting Evidence:** x-height refers to the height of the letter “x” in lower case and is a measure of typeface size (Wikipedia: x-height). One study was conducted to compare usability among three text x-heights for mobile-survey text display: 1 mm, 1.5 mm, and 2 mm. The findings show that there are no statistically significant differences in reading errors (about 2 errors per 100 words) or reading time (about 35 sec per 100 words) among the three x-height displays (Wang & Rivas 2022: Exp 5B report). A follow-up study was conducted to assess readers’ preference of character size among five text x-heights: 1 mm, 1.5 mm, 2 mm, 2.5 mm, and 3 mm. It is found that the x-height of 2 mm is the most preferred character size for display on a smartphone (Wang & Rivas 2022: Exp 5B Supplement report). The following equation describes the relationship between x-height measurement in millimeters and in pixels: Number of pixels for 1-mm x-height is equal to the inverse of the pixel size in millimeters (Number of pixels for 1-mm x-height = 1/pixel size in millimeters).

### Exhibit

The following five panels show text display on a smartphone in five different x-heights: 1 mm, 1.5 mm, 2 mm, 2.5 mm, and 3 mm. In a study of 56 participants, 1.8% preferred text of 1-mm x-height, 3.6% 1.5-mm, 48.2% 2-mm, 21.4% 2.5-mm, and 25% 3-mm.

The beaver is an excellent swimmer. It can achieve a speed of up to seven miles per hour in water. Its protection against the cold consists of a skin with thousands of single hairs and a thick layer of fat. With its big lungs it can easily stay under water for more than twenty minutes. The beaver is not only skilful in felling trees, but also an experienced craftsman in building dams. When the beaver fells a tree, it gnaws on the trunk in such a way that the upper and the lower part of the trunk are only connected with each other at a small point. When the connection is narrow and the beaver has become tired, the wind will do the rest. The twigs and thin branches are cut off by the beaver and piled up near its den, which is built on a small island. The thick branches are sorted out and

*1 mm x-height*

on the tops of high mountains and in deserts. If an empty piece of land is left to itself for long enough, after some time trees will start to grow. At first, the ground is covered with low plants. Later, bushes grow and in their shade, some of the lower plants that had established themselves first, then die. When still more time has passed, trees start to grow. As they grow bigger,

*1.5 mm x-height*

plants survive times of drought in the form of seeds which often lie buried in the ground for several years and do not put out shoots before it rains. When that happens, the plants grow very

*2 mm x-height*

deep cellar. Every night, mice came in droves out of this cellar into the shop. They ate apples and pears, grapes and

*2.5 mm x-height*

animals face the problem of how to get hold of their prey. Many animals seek and

*3 mm x-height*

### 3. Luminance Ratio between Text and Background: maintain a ratio of at least 4.5 to 1

**Supporting Evidence:** Luminance contrast is the most important determinant of legibility of symbols and text, and particularly critical to the viewers with color vision deficiency (for a brief review: Pelli & Bex 2013). *Web Content Accessibility Guidelines* (WCAG) 2.1, published by the World Wide Web Consortium (W3C 2018), stipulates that, in general, “The visual presentation of text and images of text has a contrast ratio of at least 4.5:1, ...” W3C’s guideline is adopted here because W3C/WCAG is an authoritative source for web accessibility.

#### Exhibit

The images below illustrate contrast between the blue foreground and white background. The “Good” panel shows the contrast of 4.5 to 1 between the blue text and white background, the “Poor” panel the contrast of 3.66 to 1, and the “Very poor” panel the contrast of 2.78 to 1.

4.5:1  
contrast

3.66:1  
contrast

2.78:1  
contrast

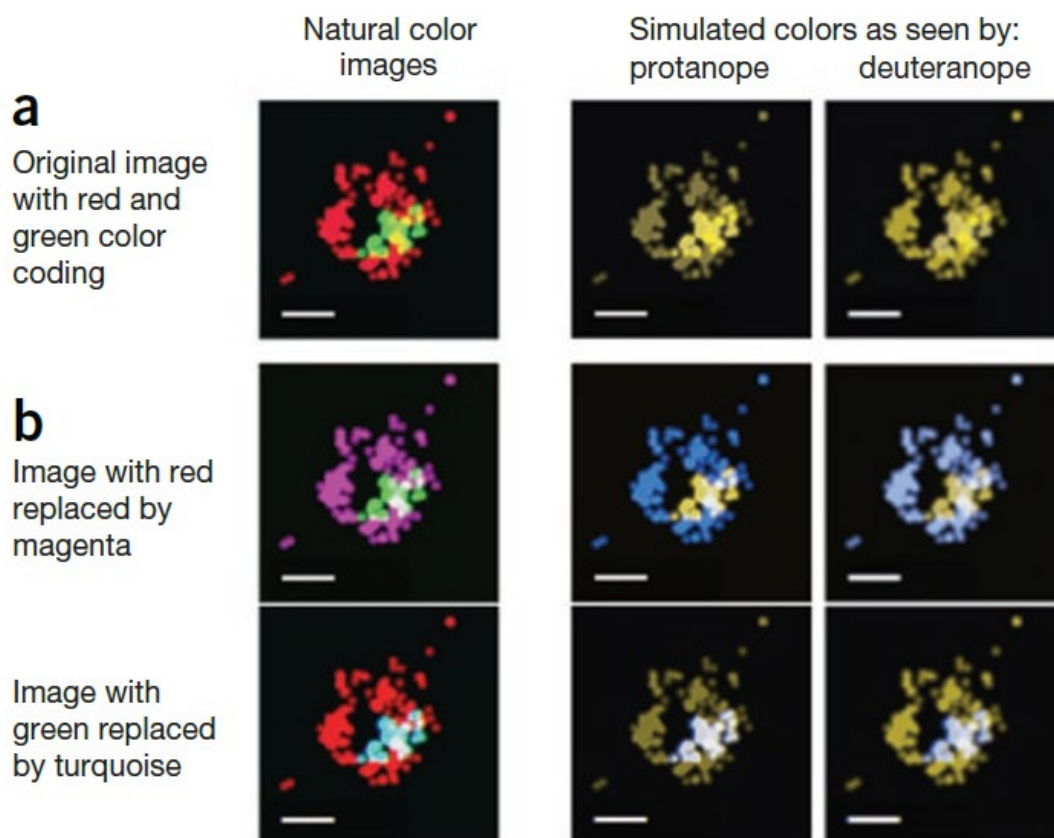
(Image source:  
<https://incl.ca/when-branding-colours-conflict-with-colour-contrast-requirements/>)

#### 4. Use of Color: avoid placing red and green colors next to each other

**Supporting Evidence:** In the United States, 8.0% of men and 0.5% of women with Northern European ancestry cannot easily distinguish red from green (red-green color blindness) (National Institute of Health 2019) . To help make the information presented on the smartphone legible for persons with colorblindness, do not place red and green colors next to each other, e.g., red text against green background (Wong 2011, W3C(b) 2018).

##### Exhibit

The images below simulate red-green color coding in an immunofluorescent image. (a) Conventional color coding is difficult for individuals with red-green color blindness to discriminate (protanopia and deuteranopia are two sub-types of red-green color blindness). (b) Replacing red with magenta (top) or green with turquoise (bottom) improves visibility for such individuals. (Source: Wong 2011)



### 3 Guidelines

Guidelines concern specific survey response operations and can be deemed as “best practices” that are highly recommended but not mandatory. In this document, the guidelines are grouped in the following categories: (1) questionnaire display or layout, (2) supporting information display (e.g., help link), (3) login ID entry, (4) navigation, (5) labeling of action buttons, (6) Question stem and response option, and (7) interviewer-administered survey. The table below provides a quick guide to each guideline.

Category	Relevant Guidelines
Questionnaire display or layout	Guideline 1 - 5
Supporting information display (e.g., help link)	Guideline 6 - 8
Login ID entry	Guideline 9
Navigation	Guideline 10
Labeling of action buttons	Guideline 11 - 14
Question stem and response option	Guideline 15 – 26
Interviewer-administered surveys	Guideline 27 - 30



## 1. Design questionnaires optimized for portrait orientation

**Supporting Evidence:** Most smartphone users hold their smartphone upright in portrait view for reading and browsing, rather than sideways in landscape view (Hoover 2013; Shirazi et al 2013; Liang & Hwang 2016).

### Exhibit

The wireframe below shows the **recommended** design of a mobile survey in *portrait orientation* on a smartphone screen.

The wireframe shows a mobile survey interface in portrait orientation. At the top, the status bar displays 'Verizon LTE', '1:53 PM', and '92%' battery. Below the status bar, the URL 'mobile.respond.qa.census.gov' is visible. The main header is a dark blue bar with the title '2015 National Content Test' in white. Below the header, the survey question is displayed: 'What is the name of each person who will be living or staying at RR 3, Box 45 on September 1, 2015? (Help)'. A blue link '(Help)' is provided. Below the question, a blue instruction reads: 'Enter names until you have listed everyone who will be living or staying there, then click Next.' The names listed so far are shown in green: 'John A Doe'. Below this, there are three input fields for the first, middle, and last names, each with a label and a text box.

Verizon LTE 1:53 PM 92%  
mobile.respond.qa.census.gov

### 2015 National Content Test

What is the name of each person who will be living or staying at RR 3, Box 45 on September 1, 2015? (Help)  
Enter names until you have listed everyone who will be living or staying there, then click Next.

The names listed so far are:  
**John A Doe**

First name 1:  
First Name

Middle name 1:  
Middle Name

Last name 1:  
Last Name

## 2. Wrap text within screen width to avoid horizontal scrolling

**Supporting Evidence:** Respondents show less tendency or willingness to scroll horizontally than vertically, to read a complete survey question if a portion of the question is outside of the display screen (Peytchev & Hill 2010). Reading an incomplete survey question without scrolling through the entire sentence may result in higher item nonresponse rate (de Bruijne & Wijnant 2014), or biased responses (Stapleton 2013).

### Exhibit

Panel A shows the **recommended** design of *wrapped text*. Panel B is an example of *unwrapped text* design. Some text in Panel B is cut off due to text being not wrapped.

Panel A shows a mobile screen with a survey question. The text is wrapped to fit the screen width. The question is: "In order to collect your address, we first need to know where you will be living on April 1, 2020. Please select where you will be living on April 1, 2020." The options are: "A U.S. state or the District of Columbia", "Puerto Rico", and "Somewhere else". A "Next >" button is at the bottom.

A



Panel B shows a mobile screen with a survey question. The text is not wrapped, causing some text to be cut off. The question is: "What is the name of each person who were living or staying at 123 MAIN ST Apt # 3 MD on April 1, 2016? (Help)". The text "Enter names until you have listed everyone who were living or staying there, then continue to the next page." is cut off. The text "The names listed so far are:" is followed by "jane doe doe". Below this is a table with two columns: "First Name" and "Middle Name". The table has two rows of input fields. A red arrow points to the "Middle Name" column header. A "Click here to add more people" button is at the bottom.

B



### 3. Display survey-sponsor logo on every screen and on invitation letter

**Supporting Evidence:** A study was conducted to compare usability among three survey-sponsor logo designs: the Census Bureau logo on every screen, on the title screen only, and no logo but the text of Census Bureau on the title screen. The findings show that a majority of participants do not perceive the logo on a mobile survey per se, but are more likely perceive a logo in an invitation letter; a government logo provides a sense of authority, authenticity, and legitimacy to the participants. Displaying a logo on a survey is, in general, preferred by most participants, with the majority preferring the logo on every screen (Wang et al 2021: Exp 33 report).

#### Exhibit

The wireframes below show the **recommended** design of placing *a logo on every screen*.

The exhibit displays ten wireframes for a mobile survey titled 'Work and Leisure Survey'. Each wireframe includes the United States Census Bureau logo in the top left corner. The wireframes are arranged in two rows of five. The first row contains the Title screen, Instructions screen, and questions Q1, Q2, and Q3. The second row contains questions Q4, Q5, Q6, and the Thank you screen. Each screen features a 'Previous' and 'Next' button at the bottom, except for the Title and Thank you screens which have a 'START' and 'END' button respectively. The Thank you screen also includes a note to 'Please hand to phone back to the test administrator.'

**Title**

United States  
Census  
Bureau

Work and Leisure Survey

START

**Instructions**

Please answer the survey as it applies to you in real life. The survey will take no more than 5 minutes to complete.

NEXT

**Q1**

Have you ever served on active duty in the U.S. Armed Forces, Reserves, or National Guard?

☐ Yes  
☐ No

Previous Next

**Q2**

Which one of the following were you in your last job?

☐ An employee of a private company for wages, salary, or commission  
☐ A local (city, county, etc.), state, or federal government employee  
☐ Self-employed  
☐ Working without pay for family business or farm

Previous Next

**Q3**

During your last job, in the weeks you worked, how many hours did you usually work per week?

Previous Next

**Q4**

Have you closely observed, fed, or photographed wildlife recreationally or maintained natural areas around your home for the benefit of wildlife in the past 5 years?

☐ Yes  
☐ No

Previous Next

**Q5**

Do you plan to fish recreationally, including shell fishing, within the next 12 months?

☐ Yes  
☐ No

Previous Next

**Q6**

Did you take any trips or outings at least one mile from your home for the primary purpose of observing, photographing, or feeding wildlife, including wild birds, in the past three months?

☐ Yes  
☐ No

Previous Next

**Thank you screen**

Thank you for your participation  
Please hand to phone back to the test administrator.

END

## 4. Use Sans Serif typefaces

**Supporting Evidence:** Sans serif fonts (e.g., Arial) tend to be preferred by readers over serif fonts (e.g., Times New Roman) for reading text on screen (Bernard et al 2001; Bernard et al 2003; Bernard et al 2002) and have been shown to enhance readability and reading performance (Hojjati & Muniandy 2014). The use of sans serif fonts at very small sizes, like what may be encountered on a mobile device, can increase reading speed (Morris et al 2002).

### Exhibit

Below are two examples of ***Sans Serif*** typefaces: Source Sans Pro and Public Sans.

Source Sans Pro:

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789

Public Sans:

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789

(Source: U.S. Web Design System)

## 5. Display text left-aligned with ragged-right margins

**Supporting Evidence:** A study was conducted to compare usability between two text alignment designs: left-aligned and center-aligned. The findings show that there are no statistically significant differences in reading speed and comprehension between the two designs; but more participants preferred left alignment than center alignment (Figuerola et al 2020: Exp13 report). In addition, other studies have shown that using ragged-right margins as opposed to fully justified text can increase reading speed (Trollip & Sales 1986) and better information processing (Ling & van Schaik 2007).

### Exhibit

Panel A shows the **recommended** design of *text left-aligned with ragged-right margins*. Panel B shows *center-alignment*. The left alignment is favored over center-alignment.

In a small town a greengrocer  
had opened a shop that was  
located above a deep cellar. Every  
night, mice came in droves out of  
this cellar into the shop. They ate  
apples and pears, grapes and  
nuts and did not spare the  
vegetables and potatoes either.  
No goods that were in the shop  
were safe from the small  
intrusive rodents between  
midnight and sunrise. As long as  
there was noise in the streets at  
night and cars were driving by, the  
mice still stayed quietly in the  
cellar. But as soon as the old

A



The beaver is an excellent  
swimmer. It can achieve a speed  
of up to seven miles per hour in  
water. Its protection against the  
cold consists of a skin with  
thousands of single hairs and a  
thick layer of fat. With its big  
lungs it can easily stay under  
water for more than twenty  
minutes. The beaver is not only  
skillful in felling trees, but also an  
experienced craftsman in  
building dams. When the beaver  
fells a tree, it gnaws on the trunk  
in such a way that the upper and  
the lower part of the trunk are

B

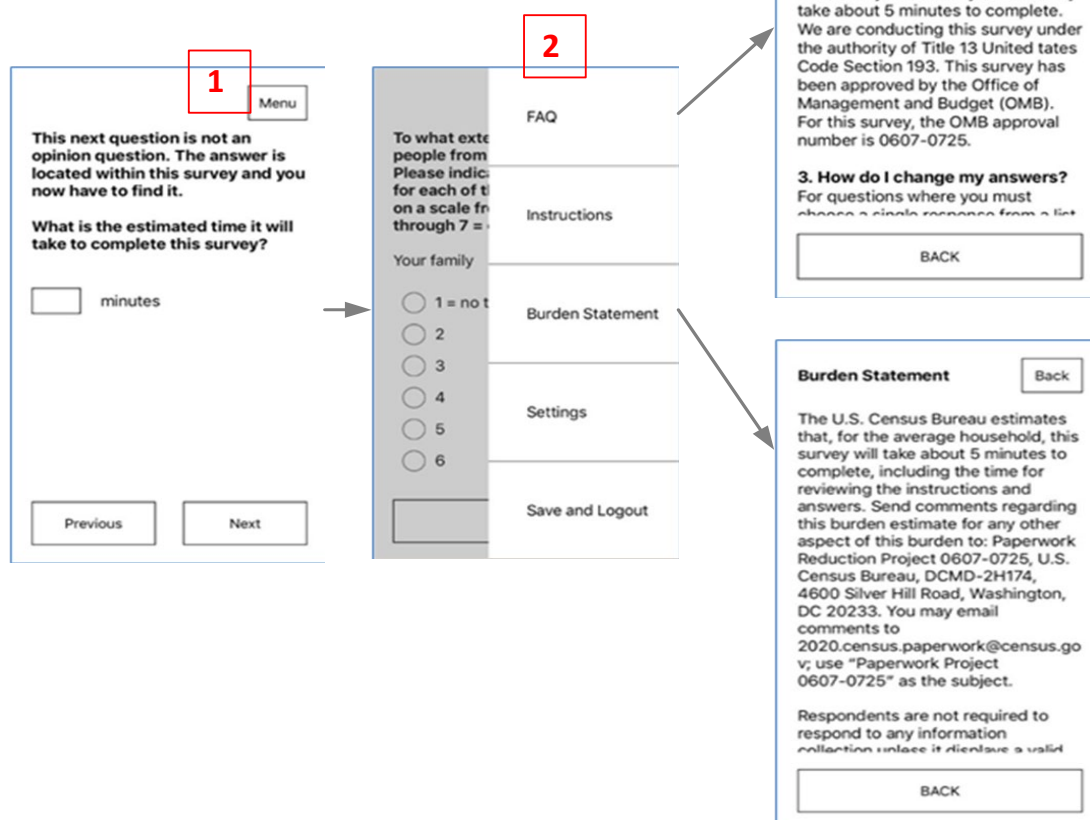


## 6. Place the link to general help information inside a menu

**Supporting Evidence:** A study was conducted to compare usability between two Help link locations: on screen (the link is visible on the screen) vs inside menu (the link is invisible until the menu is clicked). The findings show that participants have similar likelihood of using help with either design of help-link location, and similar perceived task difficulty. However, participants using the in-menu help link take less time than using the on-screen link to access the help (Nichols et al 2019: Exp 31 report).

### Exhibit

This is an example of the inside-menu Help link design. The help link, FQA, is embedded inside the Menu button. To reach the Help information, one needs to (1) click the Menu button, then (2) click FAQ.

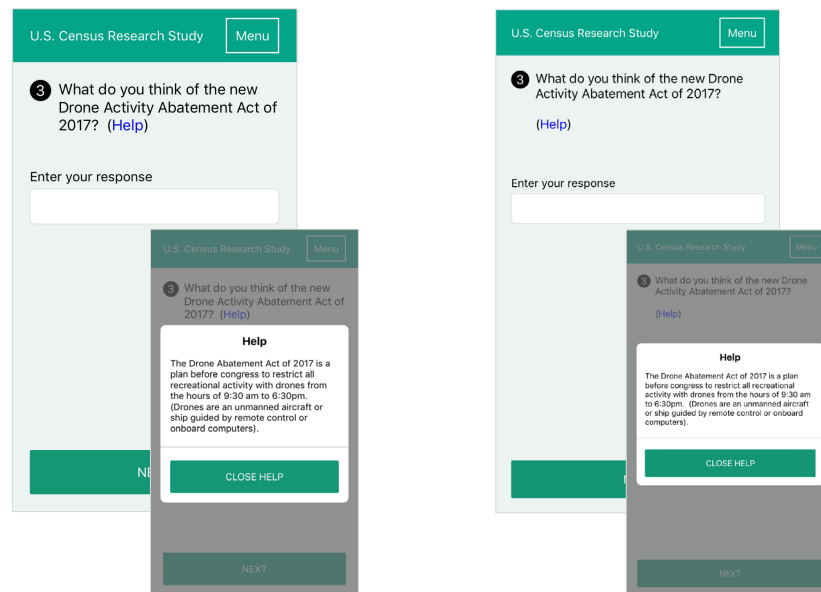


## 7. Place a question-specific "Help" link next to question stem or on a new line below question stem

**Supporting Evidence:** A study was conducted to compare usability between two question-specific "Help" link placement designs: next to the question stem (depicted in Exhibit, left side) vs. in a new line below the question stem and left adjusted (depicted in Exhibit, right side). The findings show that there are no statistically significant differences between the two designs in response accuracy, efficiency, easiness to operate, or subjective preference (Olmsted-Hawala et al, 2020: Exp 30 report). Both designs are thus recommended.

### Exhibit

The design on the left shows a "Help" link placed *next to the question stem*, while the design on the right shows a "Help" link placed in *a new line below the question stem and left adjusted*. Both designs are recommended.



"Help" link next to  
the question stem

"Help" link in a new line  
below the question stem

## 8. Display error messages at the top of screen

**Supporting Evidence:** A study was conducted to compare usability among three error message displays: popup window, inline text, text at the top of screen. The findings show that the three designs are similarly effective in prompting participants to notice errors. However, it takes least time to correct errors with the design of text at the top of screen. The design of text at the top of screen is also most preferred by participants (Nichols et al 2020: Exp 32 report).

### Exhibit

Panel A shows the **recommended** design of *text at the top of screen*, Panel B the design of *popup window*, and Panel C the design of *inline text*.

Panel A (Recommended): A form titled 'Enter the full state name.' with the question 'In what U.S. state did you last attend high school?'. The input field contains 'Ms' and is highlighted with a blue border. Below the field is a radio button for 'If you attended school outside the U.S.' and a 'Next' button. A keyboard is visible at the bottom. A green checkmark icon is below the panel.

Panel B (Popup window): A form titled 'What is your date of birth?' with the input field containing '6-6-1966'. Below the field is a 'Next' button. A popup window displays the instruction 'Enter your date of birth in this format: MM/DD/YYYY' and an 'OK' button. A red X icon is below the panel.

Panel C (Inline text): A form titled 'In what U.S. state did you last attend high school?' with the input field containing 'Md'. Below the field is a radio button for 'If you attended school outside the U.S.' and a 'Next' button. An error message 'Enter the full state name.' is displayed in red text below the input field. A red X icon is below the panel.

A B C

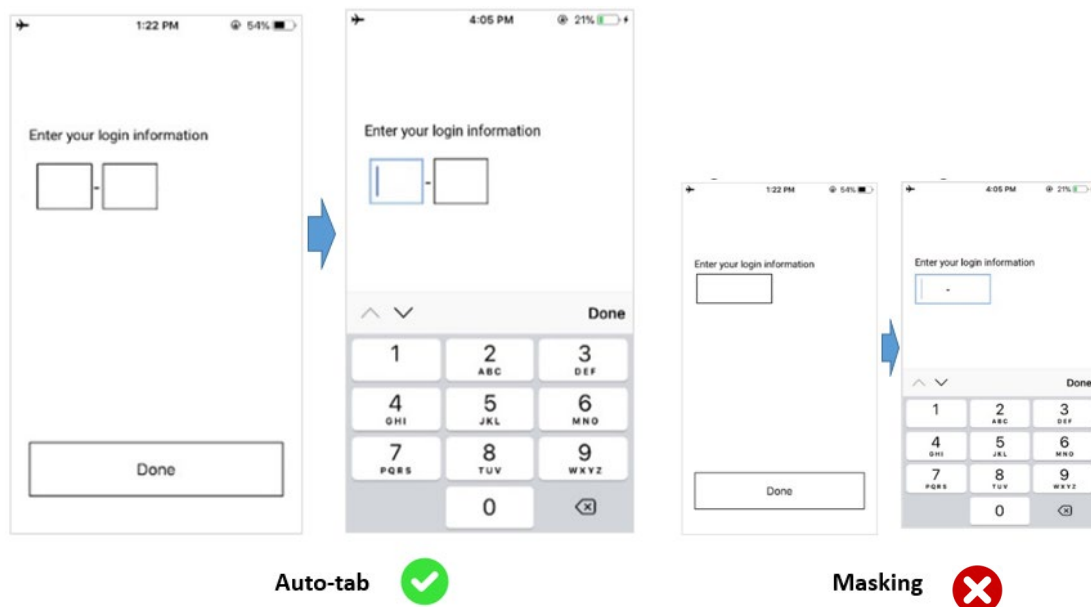


## 9. Use auto-tab formatting of segmented data entry for Login ID

**Supporting Evidence:** A study was conducted to compare usability between two numeric data entry methods: auto-tab (cursor automatically tabbing to the next field response box when data entry is completed in the current box) and masking (formatting occurring when the field response box becomes activated and hyphens appear automatically), for the segmented data type of Login ID. The findings show that participants make fewer typos using auto-tab than masking while there were no statistically significant differences between the two data entry methods in efficiency and satisfaction (Figuroa et al 2020: Exp 14 report).

### Exhibit

The left panel shows the **recommended** design of *auto-tab* for segmented Log-in data entry. In the auto-tab design, the cursor automatically tabs to the next field response box when data entry is completed in the current box. The smaller panel on the right is the design of *masking*. In the masking design, formatting occurs when the field response box becomes activated, and hyphens appear automatically.



## 10. Breadcrumb trails are not necessary for navigation

**Supporting Evidence:** A breadcrumb trail is a graphical control element used as a navigational aid in user interfaces (the right panel in the Exhibit shows an example). A study was conducted to compare usability between two navigation designs: with and without breadcrumb trail. The findings show that few participants in the breadcrumb group use breadcrumb trail; there is no statistically significant difference in task completion rate between the two designs; participants navigate through survey pages marginally faster without breadcrumb trail in one type of task but not the other type, and surveys using either design are rated as easy to complete (Falcone et al 2020: Exp 27 report).

### Exhibit

The left panel shows the **recommended** design of navigation *without breadcrumb*. The right panel is a design of *breadcrumb navigation aid* (in the red circle).

United States Census Menu

On April 1, 2016, was the house apartment, or mobile home at 100 Nowhere Lane:

- ☐ Owned by you or someone in this household with a mortgage or loan?
- ☐ Owned by you or someone in this household free and clear (without a mortgage or loan)?
- ☐ Rented?
- ☐ Occupied without payment of rent?

< >

[Accessibility](#) [Privacy](#) [Security](#)

No-breadcrumb navigation



United States Census Menu

Home > Household

On April 1, 2016, was the house apartment, or mobile home at 100 Nowhere Lane:

- ☐ Owned by you or someone in this household with a mortgage or loan?
- ☐ Owned by you or someone in this household free and clear (without a mortgage or loan)?
- ☐ Rented?
- ☐ Occupied without payment of rent?

< >

[Accessibility](#) [Privacy](#) [Security](#)

Breadcrumb navigation

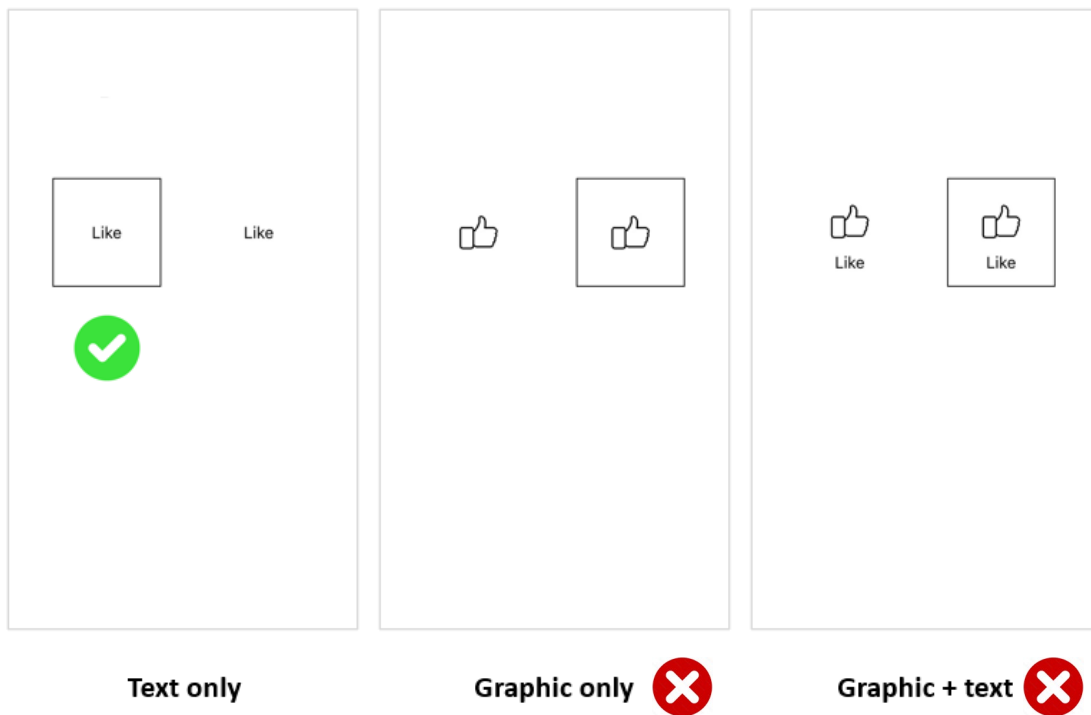


## 11. Use text to label an action button and surround the button with a border

**Supporting Evidence:** Text-labeled action buttons have higher likelihood to be correctly interpreted of their actions by users than graphic-labeled buttons (Leung et al 2011). Users with different cultural backgrounds may interpret the meaning of a graphic label differently (Kim & Lee 2005). A study was conducted to compare usability among three action button designs: Text only, graphic only, and text and graphic. The findings show that participants tap the text-only button faster than the other two designs; and for the text-only design, they prefer a button with border (Nichols et al 2019: Exp 19 report).

### Exhibit

The left panel shows the designs of *text-labeled* action buttons, the middle panel the design of *graphic-labeled* action buttons, and the right panel of *graphic plus text-labeled* action buttons. The ***text-labeled action button with a border*** is **recommended**. All the button labels in this example means a “Like” action.

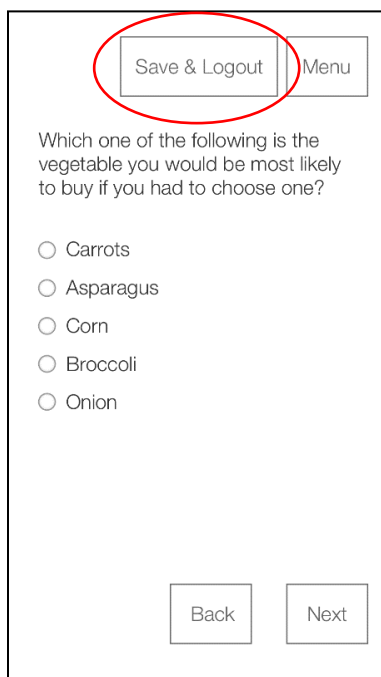


## 12. Label a Logout button with the text of “Save and Logout”

**Supporting Evidence:** A study was conducted to compare usability between two text label designs for a logout button: “Logout” vs. “Save and Logout.” The findings show that for the “Save and Logout” design, 96.7% of participants reported that they would tap the “Save and Logout” button if they had to go somewhere before finishing a survey, while 53.3% for the “Logout”. Further, for the “Save and Logout” design, 96.7% of participants reported that their information would be saved, whereas 33% for the “Logout” design. All participants prefer the “Save and Logout” button over the “Logout” button (Falcone et al 2020: Exp 12 report).

### Exhibit

Panel A shows the **recommended** design of “*Save and Logout*” label for a save-and-logout action button, while Panel B the design of “*Logout*” label for a save-and-logout action button. The two designs were highlighted with a red circle.

Panel A shows a mobile app interface. At the top, there is a header bar with two buttons: "Save & Logout" and "Menu". The "Save & Logout" button is circled in red. Below the header, the text reads: "Which one of the following is the vegetable you would be most likely to buy if you had to choose one?". There are five radio button options: Carrots, Asparagus, Corn, Broccoli, and Onion. At the bottom, there are two buttons: "Back" and "Next".

Save & Logout Menu

Which one of the following is the vegetable you would be most likely to buy if you had to choose one?

☐ Carrots

☐ Asparagus

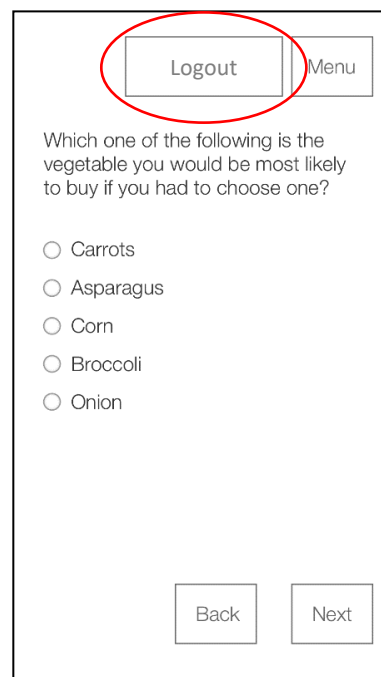
☐ Corn

☐ Broccoli

☐ Onion

Back Next

A

Panel B shows a mobile app interface. At the top, there is a header bar with two buttons: "Logout" and "Menu". The "Logout" button is circled in red. Below the header, the text reads: "Which one of the following is the vegetable you would be most likely to buy if you had to choose one?". There are five radio button options: Carrots, Asparagus, Corn, Broccoli, and Onion. At the bottom, there are two buttons: "Back" and "Next".

Logout Menu

Which one of the following is the vegetable you would be most likely to buy if you had to choose one?

☐ Carrots

☐ Asparagus

☐ Corn

☐ Broccoli

☐ Onion

Back Next

B

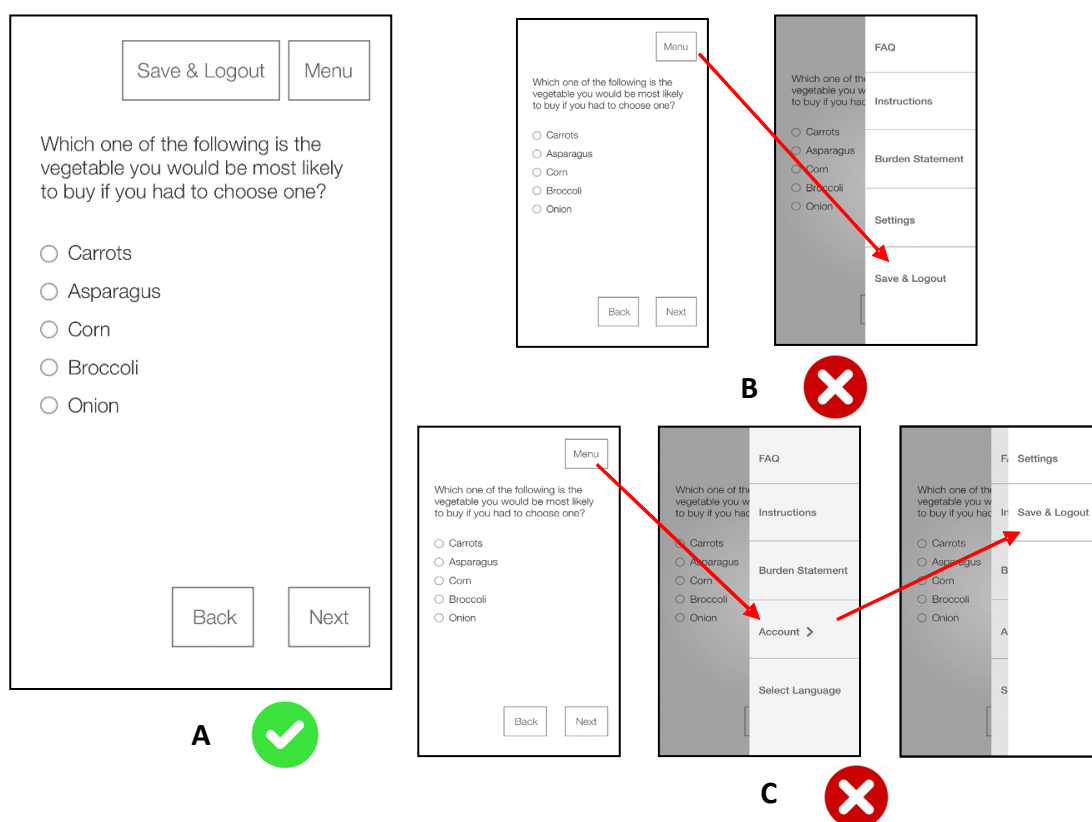


### 13. Place the “Save & Logout” action button on screen where it is visible

**Supporting Evidence:** Intuitively located, visible navigation buttons can improve usability (Brown & Nielson 2011; Ahmad et al 2018). However, given the limited space on smartphone screens, placing an action button in a sub-layer beneath the screen display is a common practice. A study was conducted to compare usability among three “Save & Logout” placement designs: visible on screen, inside main menu, inside sub-menu. The findings show that all participants successfully log out of the survey with the on-screen and main-menu designs while 54% of participants successfully logout with the sub-menu design; logout action is fastest with on-screen design; participants report less difficulty with the on-screen design; and more participants prefer on-screen placement than the other two designs (Falcone et al 2019: Exp 11 report).

#### Exhibit

The left panel (A) shows the **recommended** design of “Save and Logout” button **visible on screen**, while the upper right panel (B) the design of *inside main menu*, and the lower right panel (C) the design of *inside sub-menu*.



## 14. Label navigation buttons with the text of “Previous” and “Next”

**Supporting Evidence:** A study was conducted to compare usability between two forward-backward navigation button label designs: Icon vs. Text. The findings show that, compared to the icon label, respondents using the text-labeled button take less time to interpret the semantics of the label, navigate questions with less variation in time, make less mistakes, feel easier to use, and have a higher preference of the design (Falcone et al 2020: Exp 25 report).

### Exhibit

The left panel (A) shows the **recommended** design of *text labeling* on forward-backward navigation buttons, while the right panel (B) the design of *icon labeling*.

Panel A shows a mobile app interface with a status bar at the top displaying 'Sprint 3G', '11:26 AM', and '84%' battery. A 'Menu' button is in the top right. The main content area contains the question: 'Last week, were you employed for pay at a job or business?' followed by a subtext: 'If you were temporarily absent from a job or business (on vacation, temporarily ill, on maternity leave, etc.), answer "Yes".' Below this are two radio button options: 'Yes' and 'No'. At the bottom, there are two buttons labeled 'Previous' and 'Next'. The footer includes the 'United States Census Bureau' logo and links for 'FAQ', 'Burden Statement', and 'Preferences'.

A



Panel B shows the same mobile app interface as Panel A, but with different navigation buttons. Instead of 'Previous' and 'Next', there are two buttons with left and right arrow icons (< and >). All other elements, including the status bar, menu button, question text, radio buttons, and footer, are identical to Panel A.

B



## 15. Bold survey question stems and italicize instructions

**Supporting Evidence:** A study was conducted to compare usability among four font style designs for survey question stem and instruction: (1) bolded question stem + italicized instructions, (2) bolded question stem + regular instructions, (3) regular question stem + italicized instructions, and (4) regular question stem + regular instructions. The findings show that bolded question stems are highly preferred and reported as being easier to read though they do not improve efficiency or accuracy. Italicized instructions are found to improve efficiency without a cost to effectiveness (Falcone et al 2019: Exp 15 report).

### Exhibit

The panel below shows the **recommended** design of *bold survey question stems and italicize instructions*.

Have you completed a secondary (high) school diploma or equivalent?

*Examples of secondary (high) school equivalency certificates are General Educational Development (GED) and Adult Basic Education (ABE).*

☐ Yes, secondary (high) school diploma

☐ Yes, secondary (high) school equivalency certificate

☐ No

Next

## 16. Place no more than 10 items on the same page with scrolling but no lazy loading

**Supporting Evidence:** Studies show that respondents prefer a scrolling design with items listed vertically on a single long page over a paging design with items on separate pages. Scrolling designs also appear to decrease completion time without compromising data quality, and placing a smaller number of items (< 10) on a page has lower item nonresponse rates than a larger number of items (de Bruijne & Wijnant 2014; Mavletova & Couper 2015). Another study (Antoun et al 2020: Exp 23 report) compared four designs: Paging with each item on its own screen, scrolling with skip-based partitioning, scrolling with topic-based partitioning using a lazy loading display (In the lazy-loading display, the respondent would tap “show next question” and the next question would shift up to appear on the screen), and scrolling using a lazy-loading display. The findings show that the mean survey completion time is similar across all designs with the mean time appearing shortest for the design of scrolling with lazy loading. The number of screen taps is least for the design of scrolling with skip-based partitioning while similar for other designs. A lazy-loading display is most likely to lead to missing data. The four designs have equal likelihood of having answer changes to survey responses. It is generally easy to complete a survey with any of the designs, about 40% of participants prefer the design of paging with each question on its own screen, 30% scrolling with topic-based partitioning, 27% scrolling with skip-based partitioning, and 3% scrolling using a lazy-loading display.

### Exhibit

The left panel (A) shows the **recommended** design of *multiple questions on the same page with scrolling*. The right panel (B) shows the design of *paging with each question on its own screen*, as a special case of Panel A.

The exhibit displays two survey interface panels, A and B, illustrating different scrolling and paging designs.

**Panel A: Recommended design of multiple questions on the same page with scrolling.** This panel contains three questions stacked vertically. Each question has radio button options. At the bottom, there are two buttons: 'Previous' and 'Submit'.

**Panel B: Design of paging with each question on its own screen.** This panel contains one question with radio button options. At the bottom, there are two buttons: 'Previous' and 'Next'.

**Panel A Questions:**

- How many acres is your home on?  
☐ Less than 1 acre  
☐ 1 to 9.9 acres  
☐ 10 or more acres
- Are you currently covered by Medicare, for people 65 and older, or people with disabilities?  
☐ Yes  
☐ No
- Are you currently covered by Medicare, Medical Assistance, or any kind of government-assistance plan for those with low incomes and disability?  
☐ Yes  
☐ No
- Are you currently covered by TRICARE or other military health care?  
☐ Yes  
☐ No

**Panel B Question:**

- At any time in the last 3 months, have you attended school or college?  
☐ No, have not attended in last 3 months  
☐ Yes, public school, public college  
☐ Yes, private school, private college

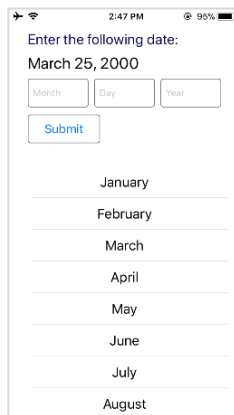


## 17. Use keyed-entry format for Date entry

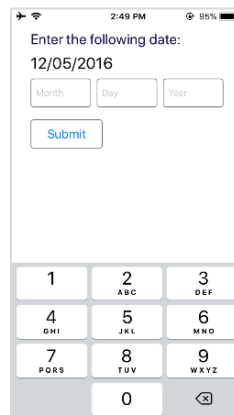
**Supporting Evidence:** A study was conducted to compare usability among three Date entry designs: Picklist, keyed-entry, and hybrid (combination of picklist and keyed-entry). The findings show that the hybrid design has the lowest rate of Date entry accuracy, though accuracy is generally high across all three designs. Time taken to enter a Date is generally shorter when date format and entry format are congruent (e.g., a display of March 2, 2010 was entered as 3/2/2010), with the shortest time in hybrid design and longest in picklist. Date entry is generally easy with any of the three designs. The picklist and keyed-entry designs are almost equally preferred by most participants, with very few preferring the hybrid design. We recommend keyed-entry format as the first choice for date entry given its effectiveness and general efficiency over picklist (Falcone et al 2020: Exp 16 report).

### Exhibit

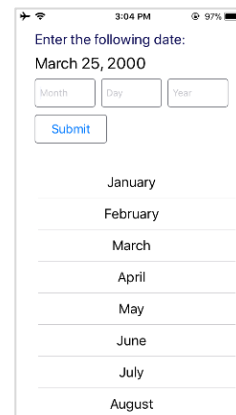
The middle panel shows the **recommended** design of **Keyed Entry**, while the left and panel the design of *pick list*, and the right panel the design of *hybrid* (combination of *picklist* and *keyed-entry*).



Picklist



Keyed entry



Hybrid



## 18. Use a radio button or text box for “Choose-one” response options

**Supporting Evidence:** A study was conducted to compare usability among three “choose-one” response option designs: iOS picker dropdown, Android spinner dropdown, and no dropdown with radio button or text box. The findings show that, participants can make responses effectively using any of the designs but most efficiently using radio button or text box, and most participants prefer the radio button or text box design (Nichols et al 2019: Exp 17 report).

### Exhibit

The top row below shows the **recommended** designs of *radio button* (A) and *text box* (B). The lower row shows the designs of *iOS picker* (C) and *Android spinner* (D).

What is the highest grade in elementary school or high school that you finished and got credit for?

☐ 7th grade  
☐ 8th grade  
☒ 9th grade  
☐ 10th grade  
☐ 11th grade  
☐ 12th grade  
☐ Don't know

Next

A



In what U.S. state did you last attend high school? Enter the state abbreviation.

State  
Md

State Done

“Md” Me Meet

q w e r t y u i o p  
a s d f g h j k l  
↑ z x c v b n m ↵  
123 😊 🎤 space return

B



In what U.S. state did you last attend high school?

Select One

AL - ALABAMA  
AK - ALASKA  
AZ - ARIZONA

Select One Done

C



In what U.S. state did you last attend high school?

Select One

MT - MONTANA  
NE - NEBRASKA  
NV - NEVADA  
NH - NEW HAMPSHIRE  
NJ - NEW JERSEY  
NM - NEW MEXICO  
NY - NEW YORK  
NC - NORTH CAROLINA

Next

D



## 19. Use 6-mm radio-button/check-box for response options

**Supporting Evidence:** A study was conducted to compare usability among four response option designs: (1) small radio button or checkboxes (2 mm in diameter/width), (2) large radio buttons or checkboxes (6 mm in diameter/width), (3) large radio buttons or checkboxes embedded in wide buttons covering the response text, and (4) plain wide buttons covering the response text (see design sketch below in the Exhibit panel). The findings show that participants made fewer errors when tapping the 6-mm radio buttons or checkboxes compared to the other designs; and more participants preferred the 6-mm radio buttons or checkboxes than the other designs (Antoun et al 2020: Exp 18 report; Antoun et al 2020).

### Exhibit

Panel A shows the **recommended** design of **6-mm radio button**. Panel B shows the four different designs of response option as described in the text above: (1) *small radio button or checkboxes* (2 mm in diameter/width), (2) *large radio buttons or checkboxes* (6 mm in diameter/width), (3) *large radio buttons or checkboxes embedded in wide buttons covering the response text*, and (4) *plain wide buttons covering the response text*.

We depend too much on science and not enough on faith.

☐ 1 = strongly disagree

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7 = strongly agree

**A**



☐ Conventional controls

☐ Larger controls

☐ Larger controls inside wide buttons

☐ Wide buttons

**B**

## 20. Display response options in vertical orientation

**Supporting Evidence:** Response options should be displayed vertically rather than horizontally for three reasons. First, respondents usually hold a smartphone upright. Second, more response options can fit on an upright-held smartphone screen when they are oriented vertically. Thirdly, long lists of response options are less problematic when they spill off the bottom of the screen than off the side of the screen. Respondents tend to scroll vertically but not necessarily horizontally, making responses options more likely to be missed by some respondents when they are presented horizontally (Borger & Funke, 2015; de Bruijne & Wijnant, 2014; Peytchev & Hill, 2010; Stapleton, 2013).

### Exhibit

The wireframe below depicts the **recommended** design of *response options in vertical orientation*.

Now we have some questions about science.

Please indicate your level of agreement with each of the following statements on a scale from 1 = strongly disagree through 7 = strongly agree.

Science and technology are making our lives healthier, easier, and more comfortable.

☐ 1 = strongly disagree

☐ 2

☐ 3

☐ 4

☐ 5

☐

The wireframe shows a survey question with a vertical list of response options. The options are numbered 1 through 5, with the first option explicitly labeled '1 = strongly disagree'. The options are displayed vertically, which is the recommended design for better fit and readability on a smartphone screen.

## 21. Use single questions in place of grids

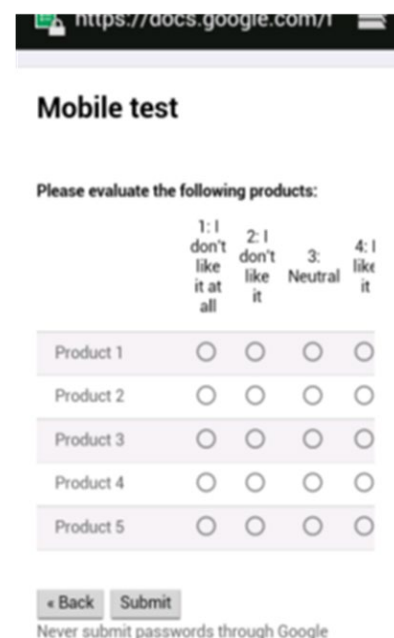
**Supporting Evidence:** Although grids seem to reduce completion times compared to single questions (Debell et al 2021), grids introduce more straight-lining (selecting the same response for every item) among smartphone users than PC users (Stern et al 2015). Splitting traditional grids into single questions helps reduce straight-lining (Borger & Funke 2015; McClain & Crawford 2013) and reduces item non-response (Debell et al., 2021). Furthermore, using single item format has been suggested to improve comparability of data across devices, e.g., PCs and smartphones (Revilla et al, 2017). In addition, grids may demand much screen space and require horizontal scrolling (Čehovin & Vehovar, 2013).

### Exhibit

Panel A shows the **recommended** design of *single questions in place of grids*. Panel B shows the *traditional grid* design. (Image source: Čehovin & Vehovar 2013)



A



B



## 22. Use either post-entry or automatic format in left or fit-to-size alignment for currency rounding formatting

**Supporting Evidence:** A study was conducted to compare usability among three United States Dollar (USD) currency amount entry formats: fixed (dollar and cent symbols being fixed in place and always present in the field), post-entry (USD being formatted only after the amount is entered in the field, at which point the USD amount is rounded to the nearest dollar and symbols of (.00) and (\$) are displayed), and automatic (symbol s of (.00) and (\$) automatically appearing in real time as the currency amount is being entered) in three different alignments (right, left, fit-to-size). The findings show that data entry is more accurate in post-entry or automatic format with left or center alignment; there are no significant statistical differences in data entry time; data entry is perceived easy across designs. The formats of post-entry and automatic are favored, compared to the fixed format (Figueroa et al 2020: Exp 20 report).

### Exhibit

Panels below show the **recommended** designs of *post-entry format with left-alignment* (A) and *fit-to-size alignment* (B). The text fields circled with a red line depict alignment designs.

1. What are the annual real estate taxes on THIS property?

Annual amount - Dollars

\$1,200.00

2. About how much do you think this house and lot would sell for if it were for sale?

Annual amount - Dollars

1200

\$0.00

1 2 3  
4 5 6  
7 8 9  
0

A

1. What are the annual real estate taxes on THIS property?

Annual amount - Dollars

\$1,200.00

2. About how much do you think this house and lot would sell for if it were for sale?

Annual amount - Dollars

1200

\$0.00

1 2 3  
4 5 6  
7 8 9  
0

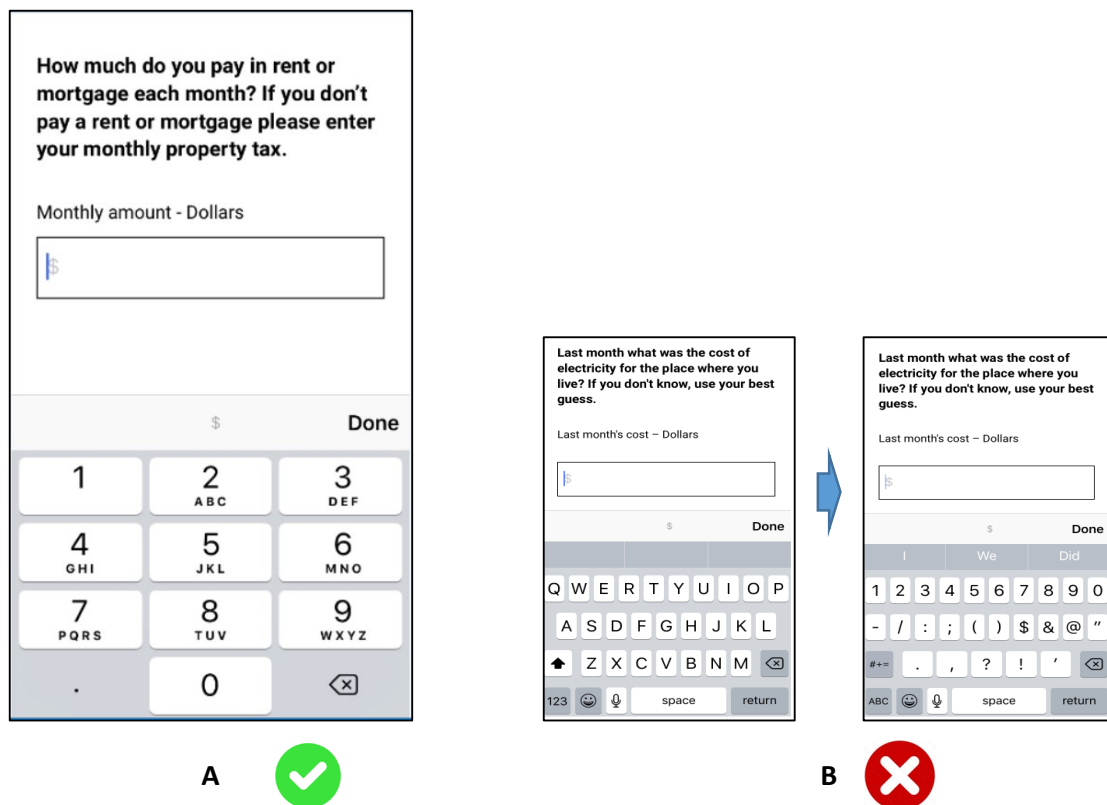
B

## 23. Use a number keypad for entering number in an open text field

**Supporting Evidence:** A study was conducted to compare usability between two number entry designs: Number keypad vs. character keyboard. The findings show that the number keypad design tends to have less number-entry errors, has a shorter initiation time to start number entry, and is overwhelmingly preferred (Olmsted-Hawala et al 2020: Exp 36 report).

### Exhibit

Panel A shows the **recommended** design of *number keypad*. Panel B shows the design of *character keyboard* which takes a respondent two steps to enter a number: Switch from alphabetic keys to numeric keys, then enter a number.



## 24. Place field label above field box and left justified or inside field box with label being displayed above field box once text is entered

**Supporting Evidence:** A study was conducted to compare usability among five field label location designs: (1) above the field box and left justified, (2) inside the field box where the label would move to above the text box when focus was placed in the field (inline label), (3) to the left of the field box and left aligned, (4) to the left of the field box and right aligned, and (5) to the right of the field box. The findings show that all participants can effectively complete surveys with any of the designs, in the same order of time, and similar degree of satisfaction. The designs of (1) and (2) are most preferred by the participants (Olmsted-Hawala et al 2019: Exp 28 report).

### Exhibit

Panel A shows the design of **field label above field box and left justified**. Panel B shows the design of **inline label** where the label is originally placed inside the field box and then moves up to above the text box when focus is placed in the field. Both designs are **recommended**.

#1 Label Above The Box

Address Number

Street Name

Apt/Unit

City

State

A

3:51 PM 54%

What is your date of birth?

Month

Day

Year

3:51 PM 53%

What is your date of birth?

Month

Day

Year

B



## 25. Place character countdown above the text field

**Supporting Evidence:** A study was conducted to compare usability among three character-countdown designs: No character countdown, character countdown below text field, and character countdown above text field. The findings show that participants make fewer typos when a character countdown was present than when it was not present, but there are no differences in preference among three designs. Place the countdown above text field in mobile surveys because it may become invisible during typing if it is below the field (Nichols et al 2019: Exp 34 report).

### Exhibit

Panel A shows the **recommended** design of *character countdown above the text field*. Panel B and C show the designs of *no character countdown* and *character countdown below text field*, respectively.

The exhibit displays three mobile survey panels, labeled A, B, and C, each with a question and a text input field.

**Panel A:** The question is "Finally, I'd like to find out how you spent your time yesterday, from 4:00 in the morning until 4:00 AM this morning. I'll need to know where you were and who else was with you. If an activity is too personal, there's no need to mention it." Below the question, the text "250 characters left" is displayed above the text input field. Below the input field is a "Next" button. Panel A is marked with a green checkmark icon.

**Panel B:** The question is "What kind of work were you doing on your last job – that is, what were your duties and responsibilities on your last job? Please be as specific as possible, including any area of specialization." Below the question is the text input field. Below the input field is a "Next" button. Panel B is marked with a red X icon.

**Panel C:** The question is "What kind of work were you doing on your last job – that is, what were your duties and responsibilities on your last job? Please be as specific as possible, including any area of specialization." Below the question is the text input field. Below the input field, the text "200 characters left" is displayed. Below the input field is a "Next" button. Panel C is marked with a red X icon.

## 26. Use predictive text for open-ended questions that have a finite list of known answers

**Supporting Evidence:** A study was conducted to compare usability between two designs of open text fields: predictive text vs. regular text. The findings show that, between the two designs, there is no statistically significant difference in accuracy. However, it takes less time to enter a response using predictive text that is also preferred by a majority of participants (Olmsted-Hawala et al 2020: Exp 38 report).

### Exhibit

Panel A shows the **recommended** design of *predictive text*. Panel B shows the design of *regular text*.

What is your race or origin?

Enter your Race

Whilkut

White

White Bear Band

White Earth

q w e r t y u i o p  
a s d f g h j k l  
↑ z x c v b n m ↵  
123 😊 🎤 space Done

A



What is your race or origin?

Enter your Race

q w e r t y u i o p  
a s d f g h j k l  
↑ z x c v b n m ↵  
123 😊 🎤 space Done

B



## 27. Place instructions visible on screen always for interviewer-administered surveys

**Supporting Evidence:** A study was conducted to compare usability between two designs of help information placement for interviewer-administered surveys on a smartphone: Instructions visible on screen always vs. instructions behind the “i” icon. The findings show that participants enter survey responses marginally more accurately with the design of the instructions visible on screen at all times than behind the “i” icon; overall survey completion time appears similar between the two designs; and there is not a statistically significant difference in proportion of participants who prefer either design, though about 20% more participants prefer the design of the instructions visible on screen at all times (Olmsted-Hawala et al 2020: Exp 50 report).

### Exhibit

Panel A shows the **recommended** design of *Instructions visible on screen at all times*. Panel B shows the design of *instructions behind the “i” icon*.

What is your race or ethnicity? You may report more than one group.

Are YOU:

☒ Show screen to respondent after reading the response options.

☐ White

☐ Hispanic, Latino, or Spanish origin

☐ Black or African American

☐ Asian

☐ Middle Eastern or North African

☐ American Indian or Alaska Native

☐ Native Hawaiian or Other Pacific Islander

02:37

A



What is your race or ethnicity? You may report more than one group.

Are YOU:

☐ White

☐ Hispanic, Latino, or Spanish origin

☐ Black or African American

☐ Asian

☐ Middle Eastern or North African

☐ American Indian or Alaska Native

☐ Native Hawaiian or Other Pacific Islander

☐ Some other race or origin

02:45

B



## 28. Place *Don't Know/Refused* option on the screen for interviewer-administered survey in conjunction with comprehensive training on response entry

**Supporting Evidence:** A study was conducted to compare the usability between two *Don't Know/Refused* response option designs for interviewer-administered setting: The response option was displayed on the screen vs. not displayed on the screen (off screen). The findings show that interviewers more likely choose the correct responses for clear *Don't Know/Refused* answers (e.g., *None of your business.*) or ambiguous but leaning-toward *Don't Know/Refused* answers (e.g., *I'm not sure, perhaps.*) when the response option is on the screen. No statistically significant differences in total survey completion time were found. Participants expressed a similar level of satisfaction with the two designs (Nichols et al 2020: Exp 51 report).

### Exhibit

Panel A shows the **recommended** design of **displaying response options on the screen**. Panel B shows the design of **not displaying response options on the screen**, where the user first selects the options button, then “Don't know/Refused” button, and then the response options appear on the screen.

The exhibit displays two survey screen designs, A and B, for a telephone number question. Both screens have the title "What is your telephone number?" and the subtitle "We will only contact you if needed for official Census Bureau business." Below this is a "Telephone Number" input field with a format of ( ) - - .

**Panel A (Recommended):** This screen shows the "Don't know" and "Refused" radio button options directly below the telephone number input field. At the bottom, there are three buttons: "Previous", "Options" (with a hamburger menu icon), and "Next". A green checkmark is placed below the "Options" button.

**Panel B (Not Recommended):** This design is shown in three sequential steps. The first screen is identical to Panel A. The second screen shows the "Options" button selected, and a new "Options" section appears below the input field, containing "Logout", "My Work", "Language", and "Don't Know / Refused" buttons. A hand icon is shown clicking the "Don't Know / Refused" button. The third screen shows the "Don't Know / Refused" option selected, and the "Don't know" and "Refused" radio button options appear below the input field. A red X is placed below the "Don't Know / Refused" button in the second screen.

## 29. Display state full name (or plus abbreviation) for interviewer-administered mobile survey instrument

**Supporting Evidence:** A study was conducted to compare usability among three designs of state name display: Full name only, abbreviation only, and abbreviation plus full name. The findings show that participants have highest correct state-selection rate with the design of full name plus abbreviation, are quicker to select a state name with the designs of full name only or full name plus abbreviation, and are most satisfied with the design of full name plus abbreviation (Nichols et al 2020: Exp 52 report).

### Exhibit

Panel A and B show the **recommended** design of *full name only* and *abbreviation plus full name*, respectively. Panel C shows the design of *abbreviation only*.

The exhibit displays three mobile survey panels, A, B, and C, each titled "What state shall I select". Each panel has a "Select One" dropdown menu and a list of states with radio buttons for selection. A "Next" button is at the bottom of each panel.

- Panel A:** Shows the full name of the state. The list includes: Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, and Missouri. This design is recommended, indicated by a green checkmark.
- Panel B:** Shows the abbreviation followed by the full name of the state. The list includes: HI - Hawaii, ID - Idaho, IL - Illinois, IN - Indiana, IA - Iowa, KS - Kansas, KY - Kentucky, LA - Louisiana, ME - Maine, and MD - Maryland. This design is recommended, indicated by a green checkmark.
- Panel C:** Shows only the abbreviation of the state. The list includes: GA, HI, ID, IL, IN, IA, KS, KY, LA, and ME. This design is not recommended, indicated by a red X.

### 30. Use bold font for outdoor viewing of mobile survey

**Supporting Evidence:** One study was conducted to compare usability between two font styles for outdoor mobile-survey text display: regular vs. bold. The findings show that there are no statistically significant differences in reading errors or reading time between the two font styles. A majority of participants prefer bold font. (Wang & Rivas 2022: Exp 6 report).

#### Exhibit

Panel A shows the **recommended** design of ***bold text*** for outdoor viewing. Panel B shows the design of *regular text*.

The beaver is an excellent swimmer. It can achieve a speed of up to seven miles per hour in water. Its protection against the cold consists of a skin with thousands of single hairs and a thick layer of fat. With its big lungs it can easily stay under water for more than twenty minutes. The beaver is not only skillful in felling trees, but also an experienced craftsman in building dams. When the beaver fells a tree, it gnaws on the trunk in such a way that the upper and the lower part of the trunk are only connected with each other at a small point. When the connection is narrow and the beaver has become tired, the wind will do the rest. The twigs and thin branches are cut off by the beaver and piled up near its den, which is built on a small island. The thick branches are sorted out and used as wood for building dams

A



The beaver is an excellent swimmer. It can achieve a speed of up to seven miles per hour in water. Its protection against the cold consists of a skin with thousands of single hairs and a thick layer of fat. With its big lungs it can easily stay under water for more than twenty minutes. The beaver is not only skillful in felling trees, but also an experienced craftsman in building dams. When the beaver fells a tree, it gnaws on the trunk in such a way that the upper and the lower part of the trunk are only connected with each other at a small point. When the connection is narrow and the beaver has become tired, the wind will do the rest. The twigs and thin branches are cut off by the beaver and piled up near its den, which is built on a small island. The thick branches are sorted out and used as wood for building dams

B



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## ***APPENDIX A***      **List of Proposed Standards**

1. Size of Touch Button: at least 6 mm of square side or circle diameter
2. Font Size for Text Display: at least 2-mm x-height
3. Luminance Ratio between Text and Background: maintain a ratio of at least 4.5 to 1
4. Use of Color: avoid placing red and green colors next to each other

## **APPENDIX B      List of Guidelines**

1. Design questionnaires optimized for portrait orientation
2. Wrap text within screen width to avoid horizontal scrolling
3. Display survey-sponsor logo on every screen and on invitation letter
4. Use Sans Serif typefaces
5. Display text left-aligned with ragged-right margins
6. Place the link to general help information inside a menu
7. Place a question-specific "Help" link next to question stem or on a new line below question stem
8. Display error messages at the top of screen
9. Use auto-tab formatting of segmented data entry for Login ID
10. Breadcrumb trails are not necessary for navigation
11. Use text to label an action button and surround the button with a border
12. Label a Logout button with the text of "Save and Logout"
13. Place the "Save & Logout" action button on screen where it is visible
14. Label navigation buttons with the text of "Previous" and "Next"
15. Bold survey question stems and italicize instructions
16. Place no more than 10 items on the same page with scrolling but no lazy loading
17. Use keyed-entry format for Date entry
18. Use a radio button or text box for "Choose-one" response options
19. Use 6-mm radio-button/check-box for response options
20. Display response options in vertical orientation
21. Use single questions in place of grids
22. Use either post-entry or automatic format in left or fit-to-size alignment for currency rounding formatting
23. Use a number keypad for entering number in an open text field
24. Place field label above field box and left justified or inside field box with label being displayed above field box once text is entered
25. Place character countdown above the text field
26. Use predictive text for open-ended questions that have a finite list of known answers
27. Place instructions visible on screen always for interviewer-administered surveys

28. Place Don't Know/Refused option on the screen for interviewer-administered survey in conjunction with comprehensive training on response entry
29. Display state full name (or plus abbreviation) for interviewer-administered mobile survey instrument
30. Use bold font for outdoor viewing of mobile survey